

IN-HOUSE DESIGN & CHECKING PROCEDURES

The primary aim in both designing and checking is to produce a structure that will safely carry the anticipated loads.

The design team, consisting of the designers, checkers, and structural detailers, is responsible for developing a set of practical, clear, and concise design notes, plans, and specifications by the assigned due date with the allotted manpower.

The *BDM* provides standard details that are workable, serviceable, and reasonably economical. In addition, these details have been approved by FHWA for general use. Departure from these standards may result in delays caused by obtaining approval.

Design Calculations

The design calculations shall be prepared on 8½"x11" sheets. The cover sheet for the final design notes of record shall be stamped by the designer & checker, and shall be indexed with numbered pages. The design calculations of record and check calculations shall be microfilmed and returned to the designer/checker. A sample form for stamping the design calculations is shown on page A0.1. An electronic copy is available on the X:drive in the Bridge Design Aids folder.

Designer

The designer's primary responsibilities include:

- Design concept and layout
- Structural design
- Preparing complete and legible calculations
- Producing a complete set of plans and specifications
- Resolving construction problems
- Load rating new/replacement bridges and bridge rehabilitation projects in accordance with the latest version of the *AASHTO Manual for Bridge Evaluation* and the *ITD Manual for Bridge Evaluation*. See below for ITD load rating procedures.

The designer should advise and get concurrence from the Group Leader whenever deviating from approved office standards and practices.

The designer should inform the Group Leader of any areas of the design that should receive special attention during checking and review.

The designer's responsibilities also include the following project planning activities:

- Obtain roadway horizontal alignment, profile grade, and typical section
 - Preparing a Design Time Estimate CPM Chart
 - Identifying tasks and planning order of work
 - Preparing design criteria for inclusion in the front of the design calculations
 - Determining the number and titles of plan sheets
 - Coordinating plan sheet detailing
 - Coordinating computation of quantities
 - Preparing the Cost Estimate, Construction Schedule CPM Chart, and Special Provisions
- Any new or significantly modified Special Provisions shall be added to the X:drive SPB folder.

Design Checker

The primary purpose of a design check is to insure that the designer has not, through an error in mathematics, misunderstanding of the specifications, or other cause, produced an unsafe design.

The design checker's primary responsibilities include:

- Verifying the design theory and correct interpretation of the design code
- Accuracy and completeness of the design calculations to confirm the structural adequacy of the components
- Independent check of major controlling geometry
- Verifying the accuracy and completeness of the load rating

The design calculations should not be checked until the Situation Layout check is completed and any differences are resolved with the designer. If revisions are necessary, the designer should revise the design and details before the design checker proceeds.

The design checker may perform an independent analysis by using a methodology different from the original design. The check notes shall be stamped and shall be returned to the designer who will coordinate changes.

For designs checked by an experienced engineer, the original calculation sheets may be initialed by the checker.

For special designs or those done by inexperienced designers, the Group Leader may require a more complete design check by the design checker.

Plan Checker

The primary purpose of a plan check is to insure plans are constructible, consistent, clear, and complete. The checker's responsibilities should include, but not be limited to, the following items:

Situation and Layout

- Make a complete check of the geometric layout. Conformance of grades, alignments, and other data between roadway and bridge plans should be checked.
- Check the Typical Section for conformance to the roadway width and bridge railing curb-curb requirements
- Check the girder spacing and type, and slab thickness for conformance to the Typical Section and office standards

Major Component Details

- Verify that the details are in agreement with the approved design calculations

Structural Detailer

The structural detailer's primary responsibilities include:

- Preparing neat, correct, and easy to follow plan sheets conforming to current detailing standards
- Drawing details to scale
- Determining dimensions and elevations as required by the designer/checker
- Calculating quantities as directed

Group Leader

The Group Leader should work closely with the designer, design checker, and structural detailer during the design and plan preparation phases to help avoid major changes late in the design process.

The Group Leader's primary responsibilities include:

- Compatibility of design and details within the project
- Determining the level of checking required by considering the complexity of the structure and the skill of the designer
- Approving the design criteria prepared by the designer before start of design
- Monitoring the design and detailing process and providing guidance and assistance as required
- Reviewing the design calculations for completeness and for agreement with office criteria and practices
- Reviewing the plans for completeness, constructibility, and agreement with office criteria and practices
- Reviewing the PS&E data for completeness and for agreement with office criteria and practices

Bridge Engineer

The Bridge Engineer provides leadership and support to assure bridge design quality for structural designs.

The Bridge Engineer's primary responsibilities include:

- Reviewing and approving the Situation Layout to assure that the most cost-effective and appropriate structure type is selected for a particular bridge site.
- Facilitating resolution of major project design issues.
- Performing a structural/constructability review of the plans.
- Reviewing the project special provisions and Supplemental Specifications

IN-HOUSE LOAD RATING PROCEDURES

To maximize the efficiency of its operations, the Department has selected the AASHTOWare Bridge Rating software (BrR formerly known as VIRTIS) for load rating. The BrR software shall be used to do the rating for the structure types listed below. For structure types not listed below, curved girders, or structures with complex geometry, alternate rating software may be used, but needs to be approved in advance by the ITD Asset Management Office.

Coding instructions for the BrR software are in Chapter 6 of the Idaho Manual for Bridge Evaluation.

(<http://itd.idaho.gov/Bridge/IMBEFirstEdition.pdf>)

Structure types that shall be rated in BrR:

- Prestressed girders
- Steel rolled girders, plate girders, or built-up sections
- Reinforced concrete girders
- Timber girders
- Trusses

Load rating submittal shall include:

- The load rating file (no hard copy; electronic copy only)
- Stamped & signed Load Rating Summary Sheet by a State of Idaho Professional Engineer (hard copy)
- Load Rating Summary Sheet (electronic file).

New/Replacement Bridge Projects

Initial BrR Load Rating Model

Initial load rating models shall be based upon the plans for the PS&E submittal and shall be submitted with the PS&E package. Future loads (i.e. future wearing surface, future utilities) shall not be input into the rating model. The load rating model should be done by the Bridge Designer and checked by a Design Checker.

Once the load rating model has been checked and all the checkers comments have been resolved, the designer shall send an e-mail to the ITD Load Rating Engineer stating the model is ready for the Q/A process with the Load Rating Summary (LRS) form included as an attachment. A hard copy of the stamped LRS form shall be delivered to the ITD Load Rating Engineer in a manila folder labeled with the Bridge Key. The PS&E plans shall be delivered to the ITD Load Rating Engineer in either electronic pdf format or 11x17 hard copy to aid in the Q/A review.

Final BrR Load Rating Model

The final load rating shall be complete prior to opening the bridge to traffic.

At time of shop drawing approval the load rating file shall be revised if necessary in order to reflect changes that would affect the load capacity of the bridge such as the use of alternate prestressed concrete girders, strand size and location or for steel girders possible adjustments to flange thickness or stiffener spacing. The bridge designer is in the best position to know what changes have been made if any during shop drawing approval and whether the BrR model needs to be updated.

It is extremely rare that any other field adjustments during construction will affect the load rating. The load rating at this stage is considered to be final and the designer, if there are no changes, shall send an email to the ITD Load Rating Engineer stating the model is ready for the Q/A process. If there are changes, the revised load rating file shall be emailed and a hard copy of the stamped updated Load Rating Summary sheet with original signature shall be delivered to the ITD Load Rating Engineer in a manila folder labeled with the Bridge Key.

The approved shop drawings shall be delivered to the Load Rating Engineer in electronic pdf format.

Bridge Rehabilitation Projects

Consistent with the opening statement of Article 0.4 that “The primary aim in both designing and checking is to produce a structure that will safely carry the anticipated loads”, all bridge rehabilitation projects shall have their load ratings reviewed and updated as necessary.

Early in the bridge rehabilitation project development the designer should verify that a load rating file exists for the bridge that is to be rehabilitated. If a load rating file does not exist for the bridge, the designer shall contact the Bridge Asset Management Office to request preparation of the initial load rating file.

The load rating file should be updated to reflect the rehabilitation project changes, such as the addition of asphaltic waterproof membranes and asphalt wearing surfaces, bonded silica fume overlays and rail retrofits. It is not necessary to update the BrR file for application of 3/8" epoxy overlays or healer/sealer treatments.

It is not necessary for the bridge designer to restamp the original Load Rating Summary Sheet. The purpose of the review and updating of the load rating and load rating file for rehabilitation projects is not to recreate or invalidate the existing load rating, but ensure that we have not substantially reduced the live load capacity of the bridge. The bridge designer will document changes made to the load rating file and email a copy of the documentation to the ITD Load Rating Engineer.

In regards to bonded silica fume overlays, historically the design practice has been to design for a minimum of 15 psf of additional future wearing surface in the original design (currently we design for 28psf of additional future wearing surface). The addition of a bonded overlay will not decrease the original design capacity. Changing the BrR model to reflect the new deck thickness including the bonded concrete overlay will produce a conservative load rating and is acceptable practice.

The designer shall send an email stating the load rating file is ready for the Q/A process indicating no changes or an updated Load Rating Summary Sheet included as an attachment. If during the Q/A process the ITD Load Rating Engineer determines revisions are needed, comments will be sent to the bridge designer for resolution. This shall be completed no later than the PS&E submittal for the project.

Bridge widening, strengthening, or full deck or superstructure replacement rehabilitation projects shall be treated as new bridges for the purposes of load rating and all the provisions for load rating of new bridges will apply.

Revisions:

June 2006	Added paragraph for Design Calculations. Added preparation of design criteria in Designer's Responsibilities. Added paragraph for duties of Bridge Engineer.
April 2008	Added load rating responsibility for Designer
July 2009	Added requirement for microfilming check calculations.
Feb 2012	Added In-House Load Rating Procedures section
August 2012	Clarified In-House Load Rating Procedures section Added new heading and paragraphs for load rating of Bridge Rehabilitation Projects
June 2013	Added designer responsibility to obtain roadway line, grade, & typical section data. Added plan checker duty to verify conformance of grades and alignments between roadway & bridge plans when checking the situation layout.
May 2014	Revised notation of VIRTIS to BrR. Added reference to BrR coding instructions in Chapter 6 of the Idaho Manual for Bridge Evaluation.